with his means of allaying pain and fever, of regulating many physiological functions, of neutralising bacterial poisons, and of determining the death of the parasites of disease. Already the chemical manufacture of pharmacologically active substances constitutes one of the vital activities of modern civilisation. But the application of chemical science to physiology and medicine is in its earliest infancy, though it will lead in time to advances as yet undreamt of. For further progress we require a finer and more subtle analysis of those wonderful chemical and physico-chemical changes which preserve the mobile and dynamic equilibrium of living matter.

The problem of life, of living matter, forms one of the great goals of chemical science, on the slow and progressive solution of which depend our future existence and well-being. At the other end of the long chain of evolution lies the problem of the birth of matter. This is perhaps the other great goal of chemical science. It is a very long way from the shining nebula to the speck of protoplasm. There are many who would dig an impassable ditch in this long road.

But however that may be, the question of the synthesis and possible reconstruction of what we call our material world is one of truly transcendant importance. The discovery that the atoms of matter can, and in certain instances actually do, break up into other atoms and into electricity we owe to the genius of French and British science, and the first recognisable transmutation was discovered at University College, London, by Sir William Ramsay and Prof. Soddy. So tremendous, however, are the forces in operation during these changes that hitherto it has proved impossible to control them in any wise. I might perhaps mention that we owe to Sir William Ramsay and to Prof. Norman Collie the first determined and courageous attempts to begin this battle of the giants. We find ourselves here in a new world of chemical and molecular science. We are the spectators of forces and velocities hitherto undreamt of. But the progress of electrical science, which has ever been the fairy godmother of chemistry, gives us reason to be of good courage.

Already we know that electricity, which is but a finer form of matter, is a component of the atom. We know from the researches of von Laue and of Prof. Bragg and his son that the excessively short electric waves sent out by certain forms of electrical discharge, the so-called X- or Röntgen-rays, can penetrate and analyse the exceedingly fine-grained atomic structure of a crystal. Is it too much to hope that still shorter and denser electric waves, sent out by the most powerful sources, may be able some day to penetrate the very core and nucleus of the atom and disturb the potent equilibrium that reigns therein?

The researches of astronomers, chemists, and physicists have shown that in the gaseous nebulæ and the early stars matter exists in forms as yet unknown to us on our planet, and that as the progress of stellar evolution proceeds we gradually arrive at stars akin in nature and composition to our sun and our own world. Is it too much to hope that we may so succeed in employing electricity and electrical energy as synthetic reagents that we shall eventually, and indeed perhaps at no distant date, arrive at the production of these simple and primary forms of nebulous matter? Whether these problems will admit of solution in the near or the distant future, or whether, indeed, some of those which I have mentioned will ultimately defy all our efforts, it is here that I would ask you to seek the profound *rôle* which chemical science is destined to play in civilisation.

EVOLUTION AND SYMMETRY.[1]

IN the animal kingdom two dominant types of body symmetry are to be found. In animals that are sedentary or floating in habit the symmetry is frequently radial, but in animals that are free and move rapidly by their own muscular activity the symmetry is bilateral. In those classes of animals now sedentary in habit, which by their developmental history show a descent from a previously free and bilaterally symmetrical ancestry, a secondary radial symmetry is usually found either in the form of the body or in the arrangement of the organs for the capture of food. Similarly in the Echinodermata some examples are found, particularly in the class Holothuroidea, of animals descended from a sedentary and radially symmetrical ancestry assuming with their freedom and increased muscular activity a secondary bilateral symmetry.

In the groups of animals that are radially symmetrical, whether sedentary or floating in habit, there is usually a far greater range of variability than in those that are bilaterally symmetrical, and in the endeavour to classify them into genera and species on the Linnean system the zoologist finds so many cases of overlapping and fusion that some doubt arises as to the existence in Nature of discontinuous specific groups.

In the order of the sea-pens there is a complete series of forms connecting the radially symmetrical colonies of the genera Veretillum and Cavernularia with the bilaterally symmetrical genera Pennatula and Pteroeides. In this series the difference between the range of variation in the radially symmetrical genera and that in the bilaterally symmetrical genera is very pronounced.

In such characters as the size of the zooids, the size and shape of the spicules, and the length of the axis, remarkable variations are found in the radially symmetrical genera. In the bilaterally symmetrical genera these characters are far more definitely fixed, and can usually be relied upon for determination of species.

Having examined a large number of specimens of the Pennatulacea collected by the *Siboga* expedition and in other collections in this country and abroad, the author believes that in some of the radially symmetrical genera there is no such discontinuity of structure as would justify their division into specific groups. In the bilaterally symmetrical genera, on the other hand, the existence of definite specific groups is certain. If this view is justified, the conclusion would be reached that the evolution of those discontinuous groups of specimens which are commonly recognised as species is correlated with the change from a radially symmetrical to a bilateral symmetry of the body.

The evidence at present at our disposal points very definitely to the conclusion that the radially symmetrical sea-pens are more primitive than the bilaterally symmetrical sea-pens, and evidence is produced which suggests that the former are derived from an Alcyonacean ancestry which assumed a floating or drifting habit.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The degrees conferred on Commemoration Day, June 26, included the following:—Doctor of Laws (*honoris causâ*), Dr. J. Ferguson, emeritus professor of chemistry; Doctor of Letters, W. H. Dunn, thesis, "The Development of English Biography"; Doctor of Science, Alex. Scott, thesis, "Contributions to the Petrology of the West of Scotland," with other papers; Doctor of Science in Public Health, Dr. W. Barr, thesis, "I.K. Therapy in Pulmonary Tuberculosis."

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[1] Summary of the Croonian Lecture on "Evolution and Symmetry in the Order of the Sea-pens," delivered before the Royal Society on June 22 by Prof. S. J. Hickson, F.R.S.

LEEDS.—Sir James Roberts, Bt., has made a gift of 10,000*l.* to the University for the foundation and maintenance of a professorship of the Russian language and literature.

LIVERPOOL.—By the will of the late Mr. N. E. Roberts 500*l.* is bequeathed to the Chancellor of Liverpool University for the benefit of the University, and 1000*l.* for the endowment of a scholarship in the department of infectious diseases, payable on the death of a niece.

LONDON.—At a meeting of the Senate held on June 21 Sir Alfred Pearce Gould was elected Vice-Chancellor for a second term of office, viz. until June, 1917. The following doctorates were conferred:—*D.Sc. in Physical Chemistry*: Mr. A. Bramley, an internal student of the Imperial College (Royal College of Science), for a thesis entitled "A Study of Binary Mixtures, with special reference to Viscosity." *D.Sc. in Chemistry*: Mr. A. F. Joseph, an internal student of the Imperial College (Royal College of Science) and Birkbeck College, for a thesis entitled "Experimental Investigations on the Properties of Bromide Solutions." *D.Sc. in Geology*: Mr. W. Jones, an external student, for a thesis entitled "The Origin of the Tin Ore Deposits of Kinta District, Federated Malay States," and other papers.

OXFORD.—The delegates of the University Museum have just presented their annual report. They direct attention to the large number of members of the teaching staff, research workers, and service staff who have been serving in the Navy or Army, or have been otherwise engaged on work directly connected with the war. In the pathological department much bacteriological work has been done for the Third Southern General Hospital; a standards laboratory has also been set up, and is occupied in the preparation and issue of standard agglutinating cultures and serums for use in the diagnosis of typhoid and paratyphoid fevers. The report in physiology records researches by the Waynflete professor, by Dr. Vernon, Dr. Chuai Asayama, of Kioto, and Prof. Denys, of Louvain. It also mentions the gaining of the V.C. by Lieut. Maling, a physiology student in 1909–10, and adds that of recent students in the department ten have lost their lives in the war. In the department of zoology and comparative anatomy research has been carried on, in the absence on military service of the Linacre professor, by the deputy-professor and Mrs. Goodrich, by Mr. G. W. Smith and Mr. J. B. Gatenby. A representative collection of insects, presented by the Hope department, has been prepared and exhibited. Since the resignation, after fifty years' service, of Prof. Clifton, the work of his department has been carried on by Mr. James Walker. Research on wireless telegraphy for the naval air service has been conducted by the Wykeham professor of physics, who reports with great regret the loss in action of Mr. H. G. J. Moseley, 2nd Lieut. R.E., already a very distinguished physicist. War work, as well as other forms of activity, has gone on, under Prof. Perkin, in the new chemistry laboratory now open. The report of Mr. H. Balfour, the curator of the Pitt-Rivers Museum, contains a long list of donations, some of the most important of which were procured by Miss M. Czaplicka during her recent expedition to Siberia. Other accessions worthy of special mention came from Mr. J. H. Hutton and from Mrs. Sollas, the latter forming part of the collection made by the late Prof. Moseley during the voyage of H.M.S. *Challenger.*

The School of Geography announces that a vacation course for teachers and others interested in geography will be held this year from August 3 to August 18. Particulars of the lectures and classes planned, with other information, may be obtained on application to the vacation course secretary, School of Geography, 40 Broad Street, Oxford.

The third conference on new ideals in education will be held at Oxford on July 29–August 5. The programme includes papers on The Boy Scout movement, by Sir Robert Baden-Powell; The place of science in education, by Sir Henry Miers; Universities and their re-planning, by Prof. Geddes; Workmanship and education, by Mr. H. Wilson; and Regional studies and human surveys, by Prof. Fleure. Among the chairmen are the Earl of Lytton, Lord Sydenham, Sir William Mather, Dr. Macan (Master of University College, Oxford), Rev. T. Provost (of Oriel College, Oxford), Mr. Fred Burridge, Miss Caroline Herford, Mr. A. C. Coffin, and others. All information with reference to the conference can be obtained from the Secretary, 24 Royal Avenue, Chelsea, S.W.

FOLLOWING on the large developments undertaken by British Dyes, Limited, the governors of the Huddersfield Technical College have decided to establish a new department for specialised study and research in coal-tar colour chemistry (aniline and alizarine dyes). The department has been placed under the headship of Dr. A. E. Everest, now lecturer in chemistry at University College, Reading, who, during recent years, has been carrying out a series of investigations upon colours and plant pigments. Work will be commenced in September next, and the department will provide advanced teaching in matters relating to the production of dyestuffs, colours, and other allied substances. Facilities will be offered for research of all kinds relating to the chemistry of colouring matters. The department will be worked in close connection with the existing departments of chemistry and of dyeing, thereby giving its students the benefit of keeping in touch with the practical application of the products to be dealt with. Spacious laboratories are to be provided, furnished with modern equipment and arranged with a view to special attention being devoted to research. The department is being founded with the full concurrence and support of the directors of British Dyes, Limited, who are prepared to contribute towards its establishment.

MIDDLESBROUGH, the most important iron centre of the north of England, has depended in the past for its research work upon the enterprise of individual firms, but the question of erecting a technical college where students could be trained efficiently to take their places in the works' laboratories has been persistently before the Education Committee for some years. A plan for erecting a college was seriously contemplated in 1914, but the outbreak of war, by preventing the raising of a loan, caused any prospect of building to be relegated to the conclusion of hostilities. The opportunity to make progress in metallurgical science was not postponed, for the Cleveland Institution of Engineers took the matter in hand and designed to start a research laboratory of its own. The plan was progressing when, on June 5, a combined meeting of the Cleveland Institution of Engineers and the education authorities of Middlesbrough and the neighbouring localities was held to hear of the munificent offer of Mr. Joseph Constantine to guarantee a sum of 40,000*l.* for the erection of a technical college on a piece of ground which had already been purchased by the Middlesbrough Town Council for such a purpose. This splendid offer was accepted with considerable applause and gratitude, and led to other members of the meeting making further offers. Messrs. Bell Bros., Ltd., and Messrs. Dorman, Long and Co., Ltd., and their allied firms offered 10,000*l.*, and Messrs. Sir Bernard Samuelson and Co., Ltd., 5000*l.*, towards the equipment. It is expected that the sum of 100,000*l.* will be obtained without difficulty. The minor scheme of establishing a metallurgical laboratory is being proceeded with, and part of its equipment may come out of the generous donations which have been made, and at the end of the war the equipment will be transferred to the new Constantine Technical College.

It is somewhat of a novelty to find in a paper such as the *Manchester Guardian,* in its issue of June 19, a full-column advertisement urging the claims of education. But "it brings hope with it and forward-looking thoughts," since it gives welcome evidence that the value of education has at last come home to the British business man, who now sees that "national education of the broadest possible kind is the only method by which we can secure permanent British trade supremacy." The advertiser, Mr. C. F. Higham, realises that this cannot be done unless measures are taken to ensure for every child of the nation "a sound, efficient education" at the hands of more and much better paid teachers, and that such effective training should be followed by specialised teaching in every branch of industry for both employers and employed. He further urges a closer co-operation between capital and labour, and a better appreciation of their respective functions. "National education is a fundamental need." It "should be the national extravagance after the war." Let us maintain the same energy of organisation and of production for the purposes of peace that we have shown in equipment for war. The cost will be heavy, but it is the price demanded for efficiency, and, as the war has clearly shown, our financial resources are fully equal to any demands required for the well-being of the nation. This is a timely plea that British industrial enterprise shall be fostered and maintained upon a sound footing, namely, that of an "all-round enlightenment," and that no mere "tinkering with tariffs or making mild concessions after strikes will ensure it." Amidst all this strife it might, perhaps, be as well to listen to a voice of the eighteenth century, that of Rousseau in his "Emile": 'To live is the trade I would teach him."

SOCIETIES AND ACADEMIES.

London.

Royal Meteorological Society, June 21.—Major H. G. Lyons, president, in the chair.—J. E. **Clark** and H. B. **Adames:** Report on the phenological observations for 1915. The year, as a whole, approximated closely to the mean for the twenty-five years over which records now extend, being, if anything, a shade earlier; but this new mean for England and Wales, falling on May 18 (taking the whole British Isles, the mean date is May 21), is a day earlier than that for the twenty years. Every one of the intervening years was early, whilst the four preceding these had been late; 1914 was seven days earlier than 1915, of which the outstanding features were the mild and very wet winter; the following period of drought, interrupted in most parts through July and early August, in others almost continuous through October; the genial conditions, as a whole, in April and June, but with cold spells and frosts in May and June; the cold, sunless, wet July, followed by a genial autumn ending in the unprecedented November frosts. The cold periods in spring affected migrants adversely, the mean date being April 26, compared with April 24 in 1914 and April 23 for the twenty years' mean of the *Natural History Journal* records, 1877 to 1896. An important appendix deals with a communication by Dr. Ihne, of Darmstadt, extending to the British Isles the mean date, in six weekly zones, of the coming of spring in various parts, such as he has carried out for the Continent. The map representing this roughly shows that Central England corresponds to Belgium, North England and the Lowlands of Scotland to Holland, and the northern Highlands to Denmark. Ireland has similar zones, except the last, the southern parts, as also in England, coming under the two earlier zones, starting from April 17.—M. **Christy** and W. **Marriott:** Audibility of the gun-firing in Flanders over the south-east of England, September, 1914–April, 1916. The sound of the fighting in Flanders has been repeatedly heard in many parts of the south-east of England since an early period of the war. From the records collected it appears that the gun-firing has been heard at one time or another over the counties of Essex, London, Kent, Surrey, and Sussex, the most distant place being about 150 miles from Ypres. The weather charts show that generally there is a somewhat irregular or not definitely defined distribution of barometric pressure, but mostly with a region of high pressure wedged in between areas of slightly lower pressure. These conditions are such as to produce light winds at the surface, mostly between north and east, over the neighbourhood of the North Sea. Aspect and elevation are also important factors for the hearing of the firing.—Lieut. F. H. **Chapman:** The relation between atmospheric pressure and rainfall at a single station. In this paper the author deals with the relationship between (1) actual pressure values and rainfall, and (2) mean pressure values and rainfall totals. The former relationship is small, and the author deals with it by the method of probability values. Curves are given showing the chances of rain at Kew during the hour 6.30 a.m.–7.30 a.m., and during the twenty-four hours 7.30 a.m.–7.30 a.m., according to the height of the barometer at 7 a.m. These curves are based on data for Kew for the ten years 1904–13. The relationship between mean pressure and rainfall totals is dealt with by the method of correlation. The coefficients obtained are high, and the corresponding regressions are shown to be very nearly linear. In this latter part of the paper, data for Kew and Valencia for the forty-seven years 1869–1915 are used.

Mineralogical Society, June 20.—Dr. A. E. H. Tutton, past-president, in the chair.—Dr. J. W. **Evans:** The relations between different laws of twinning giving the same twin-crystal. If the untwinned crystal has no symmetry, different twin-laws give different results. In the presence of a centre of symmetry an axis of rotation-twinning is an axis of reflection-twinning. An axis of rotation-twinning lying in a plane of symmetry has at right angles to it in the same plane an axis of reflection-twinning. If the normal to a plane of symmetry be an axis of rotation-twinning, or if a line of symmetry (axis of even symmetry) be an axis of reflection-twinning, the same result may be obtained by the complete inversion of the structure; *vice versâ,* in an inversion-twin the normal to every plane of symmetry is an axis of rotation-twinning, and every line of symmetry is an axis of reflection-twinning. If a twin-axis be at right angles to an axis of *n* degrees of symmetry, there will be in all *n* twin-axes of the same kind at right angles to the